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# FOREST RESEARCH NOTES

CALIFORNIA FOREST AND RANGE EXPERIMENT STATION
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## MORTALITY OF WHITE FIR FOLLOWING DEFOLIATION BY THE DOUGLAS-FIR TUSSOCK MOTH IN CALIFORNIA, 1957

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In 1954 the Douglas-fir tussock moth began defoliating white fir in the Stanislaus National Forest. Depredations mounted until the infestation was controlled by an aerial application of DDT during the summer of 1956. Mortality of the defoliated white fir was just beginning to show up in 1957, but data from the first year of study indicates mortality is occurring in a serious amount.

### The Insect

The Douglas-fir tussock moth, Hemerocampa pseudotsugata McD., is a brown, fuzzy moth about an inch long. The female has no wings and the eggs remain within her body until she becomes an immobile, bloated, egg mass. She dies in this condition in the fall. In early summer of the next year, the eggs hatch into hairy, tufted caterpillars which feed on the needles of white fir, especially of the upper crown, for several months. They pupate in late summer and turn to adult moths in mid-September.

### Infested Area

The infestation covered 7 scattered blocks of white fir, comprising 10,000 acres of the Stanislaus National Forest and adjacent private land. The largest and most heavily defoliated block, located at the southern end of the national forest, contains 5,000 acres. The other 6 blocks are strung out toward the north at 5,000 feet elevation and are much smaller in size.

## Methods

A series of $\frac{1}{2}$-acre, circular, tagged-tree plots were established in the infested areas to study the effects of tussock moth defoliation upon white fir (most plots had a 1/40-acre subplot to measure loss of small trees). These plots are located in areas of three degrees of defoliation intensity: light, moderate and heavy. The heaviest defoliated area was on Hell's Mountain. Plots proceed northward to the lightest defoliated area at Summit Level Ridge. The plots will be checked annually in August for amount and cause of mortality to defoliated white fir, until final examination in 1960. At that time increment cores will be taken to study radial growth loss due to defoliation.

## Results

The first year's check of the plots in 1957 showed that 21 percent of the trees--containing 8 percent of the volume--were killed on heavily defoliated plots (tables 1 and 2). One-fourth of this mortality was caused by defoliation alone; other defoliated trees were killed by the fir engraver and flatheaded and roundheaded fir borers.

Only those trees 50 to 100 percent defoliated were killed (figure 1). Eighty-two percent of the trees died that were 90 to 100 percent defoliated. Damage to trees less than 50 percent defoliated is likely to be in the form of reduced growth.

Trees in the 6- to 12-inch diameter class suffered 28 percent of the mortality (figure 2). The largest tree killed had a diameter of 38 inches.

Table 1.--Number of white fir[1/] killed: by defoliation intensity class, and cause, Stanislaus National Forest, 1957

| Defoliation intensity class | No. trees | Killed by defoliation alone | | Defoliated trees killed by other insects | | Total mortality | |
|---|---|---|---|---|---|---|---|
| | | No. | Percent | No. | Percent | No. | Percent |
| Heavy plots 1-9 | 413 | 21 | 5.1 | 65 | 15.7 | 86 | 20.8 |
| Moderate plots 10-16 | 297 | 0 | 0 | 1 | 0.3 | 1 | 0.3 |
| Light plots 17-23 | 254 | 1 | 0.4 | 1 | 0.4 | 2 | 0.8 |

1/ Includes trees 6.6 inches d.b.h. and over and red fir on one plot. Twenty-eight percent of the small white fir (6.5 inches and under in the 1/40-acre subplots) were killed on plots 1-9, six percent on plots 10-16, and none on plots 17-23.

Table 2.--Volume of white fir[1/] killed: by defoliation intensity class, and cause, Stanislaus National Forest, 1957

| Defoliation intensity class | Volume bd.-ft. | Killed by defoliation alone | | Defoliated trees killed by other insects | | Total mortality | |
|---|---|---|---|---|---|---|---|
| | | Vol. | Percent | Vol. | Percent | Vol. | Percent |
| Heavy plots 1-9 | 245,450 | 1,220 | 0.5 | 19,070 | 7.8 | 20,290 | 8.3 |
| Moderate plots 10-16 | 48,110 | -- | -- | -- | -- | -- | -- |
| Light plots 17-23 | 66,310 | -- | -- | -- | -- | -- | -- |

1/ Includes only trees 11 inches d.b.h. and over.

Figure 1.--Mortality of white fir[1] on plots 1-9 by percent defoliation, 1957.

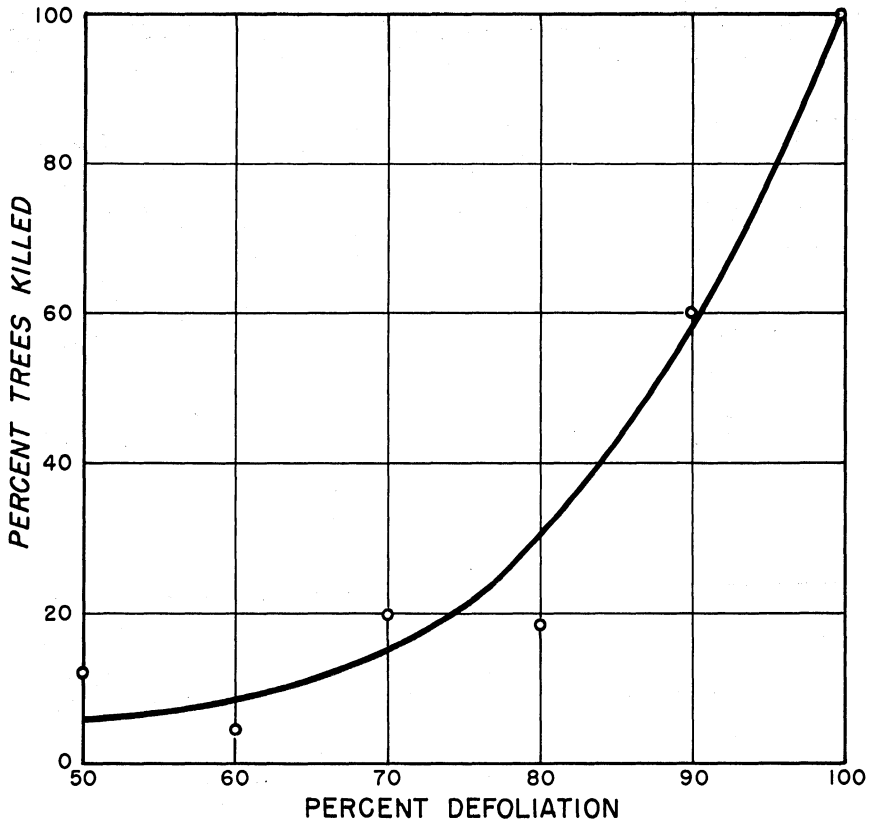
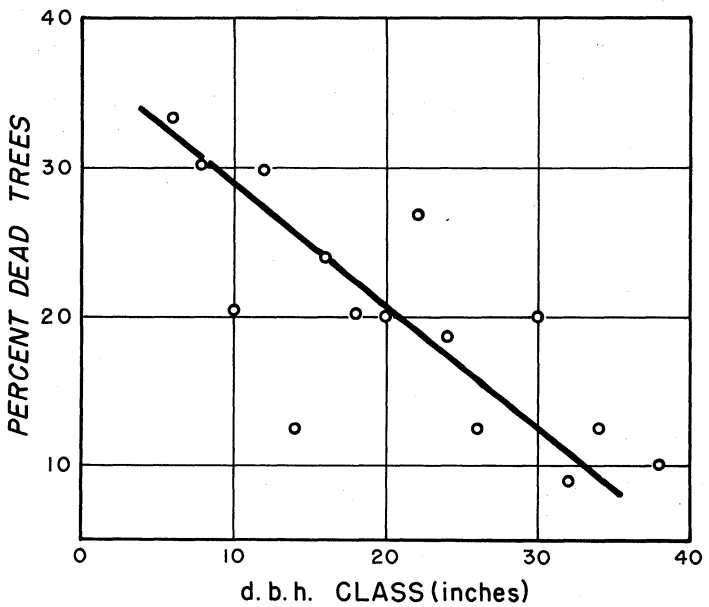



Figure 2.--Percent mortality of white fir on plots 1-9 by diameter class.[2]




1/ Includes trees 6.6 inches d.b.h. and over.
2/ Thirty-six-inch class omitted because of small sample.

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